550307

FLOOD INSURANCE STUDY

VILLAGE OF LITTLE CHUTE, WISCONSIN

OUTAGAMIE COUNTY

DECEMBER 15, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 550307

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Exhibit 2 - Flood Boundary and Floodway Map Index
Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY

VILLAGE OF LITTLE CHUTE,
OUTAGAMIE COUNTY, WISCONSIN

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Village of Little Chute, Outagamie County, Wisconsin, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the Village of Little Chute to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Carl C. Crane, Inc., for the Federal Insurance Administration, under Contract No. H-4785. This study was completed in October 1979.

1.3 Coordination

Streams requiring detailed and approximate study were identified at a meeting attended by representatives of the Study Contractor, the FIA, the Wisconsin Department of Natural Resources, and the Village of Little Chute on April 27, 1978.

On July 29, 1980, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor and the FIA, and community officials.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Village of Little Chute. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through October 1984.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by the FIA and the Village of Little Chute.

The Fox River was studied in detail from the east to the west corporate limits of Little Chute. The U.S. Canal was studied by approximate methods within the corporate limits.

2.2 Community Description

The Village of Little Chute is located in the east-central portion of Wisconsin, in the southeastern portion of Outagamie County. The Village of Little Chute is bordered on the north and west by the unincorporated areas of Outagamie County, on the south by the Fox River, and on the east by the incorporated areas of Kaukauna. The incorporated areas of Combined Locks and Kimberly are located across the Fox River from Little Chute. The total land area contained within the village limits is approximately 3.0 square miles. Little Chute was incorporated in 1899. Its population in 1970 was 5,522 (Reference 1).

The climate in east-central Wisconsin is characterized by wide variations in temperatures. Average summer and winter temperatures for the years 1967 through 1977 ranged from 72 degrees Fahrenheit (F.) to 11 degrees F., respectively. Annual average precipitation of the region is 29.0 inches with an average recorded snowfall of 42 inches. Precipitation is normally higher in the spring and summer months (References 1 and 2).

The surface of Outagamie County is quite gently sloping and without prominent relief. The Fox River flows northward across the southeastern portion of the county. The geological formations are the upper Cambrian (Potsdam) sandstone, the lower Magnesian limestone, the St. Peter sandstone, and the Galena - Platteville (Trenton) limestone. These indurated rock formations are quite generally covered with glacial drift on the divides, and alluvial sand and gravel and glacial drift in the valleys. The lower Magnesian formation is variable in character, consisting largely of limestone in the Little Chute area (Reference 3).

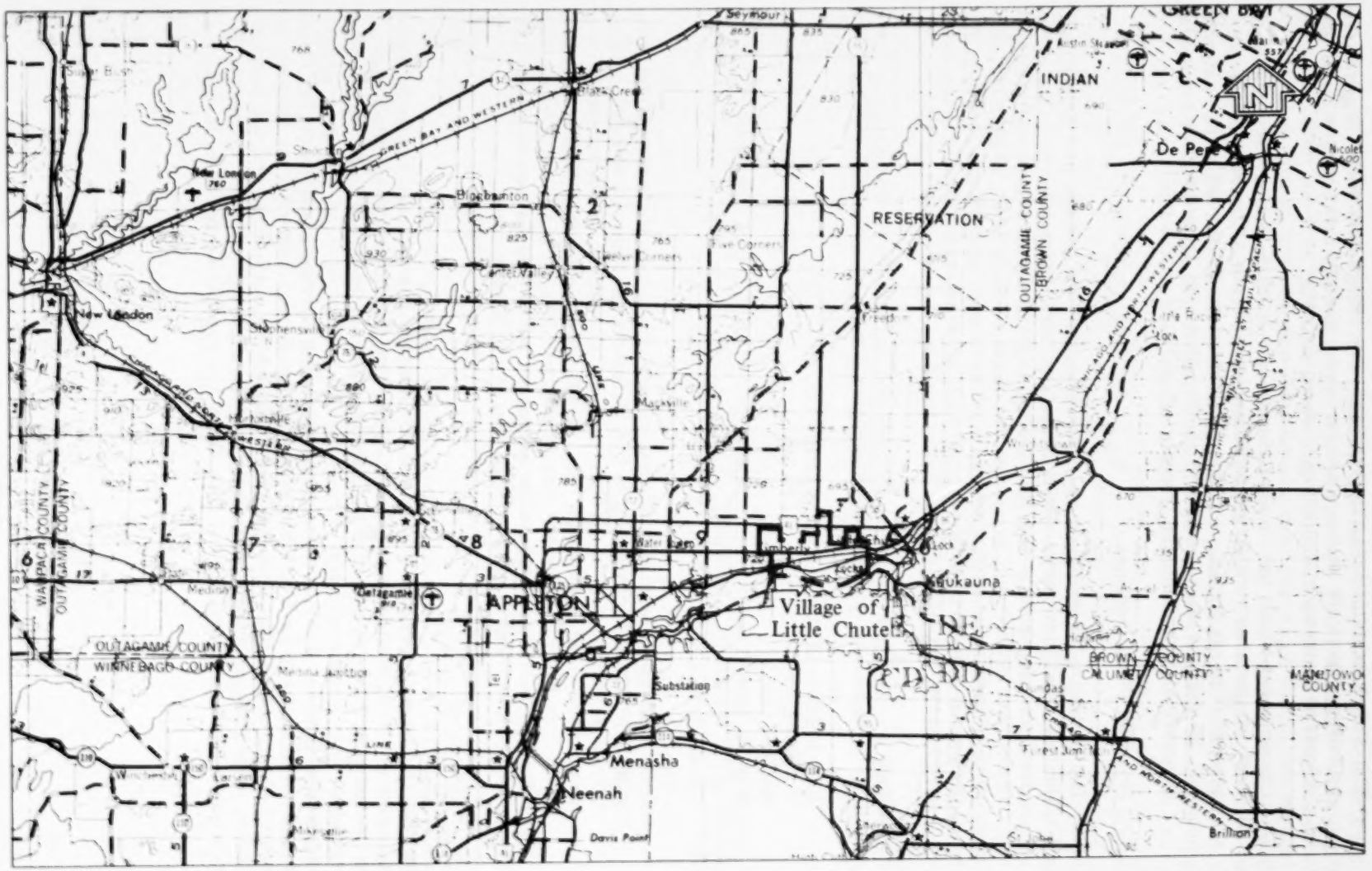

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

VILLAGE OF LITTLE CHUTE, WI
(OUTAGAMIE CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

The Fox River flows easterly through the village and forms its western boundary. The total drainage area is approximately 6,111 square miles and is located upstream of the village corporate limits.

Development within the flood plains throughout Little Chute is minimal with most of the area consisting of open space. About 40 percent of the total acreage is in residential use, with approximately 10 percent in recreational use, 30 percent open lands, and the remainder in all other uses (including commercial, industrial, and transportational).

2.3 Principal Flood Problems

The history of flooding on the streams within the Village of Little Chute indicates that most major floods on the Fox River have occurred in the early spring and are usually the result of spring rains and/or snowmelt. Major floods have occurred in the lower Fox River basin in 1943, 1946, 1952, and 1960. Magnitude and frequency for these floods, as measured by the U.S. Geological Survey (USGS) gaging station at Rapide Croche Dam near Wrightstown (no. 04-0845), are listed below:

Date	Discharge cubic feet per second (cfs)	Frequency years
June 6, 1943	21,300	17
March 27, 1946	21,300	17
April 18, 1952	24,000	43
May 18, 1960	23,600	33

2.4 Flood Protection Measures

Lake Winnebago acts as a natural reservoir to store floodwaters and thus attenuate peak discharges. A U.S. Government Dam at Menasha and a privately owned dam at Neenah control the outlets which discharge the water from Lake Winnebago into Little Lake Butte Des Mortes and the lower Fox River. There are numerous other dams in the Little Chute area, but their main functions are for recreation and hydraulic power generation and not flood control.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a

specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten), and for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for the flooding source studied in detail affecting the community.

The peak discharges used in this report were taken directly from the HEC-1 analyses done for the Fox River Flood Plain Information Report (References 4 and 5).

Peak discharges for the 10-, 50-, 100-, and 500-year floods of the flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
FOX RIVER					
Little Chute Dam	6,110	21,200	24,900	26,500	29,600
Combined Locks Dam	6,111	21,200	24,900	26,500	29,600

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along the flooding source studied in detail.

For the purpose of this report, the results of the hydraulic analysis were transferred directly from the Fox River Flood Plain Information Report (Reference 4). Cross sections used in this study were determined through field surveys conducted by the U.S. Army Corps of Engineers (COE).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen using engineering judgment and based on field observations. Manning's "n" factors ranged from 0.05 to 0.07 for the overbanks and from 0.030 to 0.035 for the channel.

Starting water-surface elevations used in this computation were obtained from rating curves developed for Little Chute Dam and Combined Locks Dam (Reference 6). These curves were determined through structural analysis of the dams. Water-surface elevations of floods of the selected recurrence intervals were computed through the use of the COE HEC-2 step-backwater computer program (Reference 7). Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1). The profiles in this study were also taken directly from the Flood Plain Information Report (Reference 4).

The U.S. Canal located within the Little Chute corporate limits was studied by detailed methods in the Fox River Flood Plain Information Report (Reference 4). However, for the purpose of this report, this area was determined to be a minimal flood hazard and labeled an approximate study zone. The approximate boundaries agree with the 100-year boundaries obtained from the Fox River Flood Plain Information Report.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using topgraphic maps at a scale of 1:62500, with a contour interval of 20 feet (Reference 8). The approximate boundaries were also delineated on the above-referenced maps.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. However, the Wisconsin Department of Natural Resources has established a policy that limits encroachment in the flood plain to 0.1 foot (Reference 9).

The floodway in this study was developed using engineering judgment and the HEC-2 computer program (Reference 7) to reflect the existing effective flow limits. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
FOX RIVER							
A	25.29	558/261	6067	4.45	659.1	659.1	0.0
B	25.94	775/425	3359	8.04	660.6	660.6	0.0
C	25.98	715/415	9904	2.68	677.1	677.1	0.0
D	26.39	1085/575	10,192	2.60	677.5	677.5	0.0
E	26.80	900/410	4083	6.49	678.6	678.6	0.0
F	26.86	760/300	3421	7.75	679.9	679.9	0.0
G	26.90	830/330	9325	2.84	691.8	691.8	0.0
H	27.06	620/320	6948	3.81	692.0	692.0	0.0

[1]MILES ABOVE MOUTH
[2]TOTAL WIDTH / WIDTH WITHIN CORPORATE LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

VILLAGE OF LITTLE CHUTE, WI

(OUTAGAMIE CO.)

FLOODWAY DATA

FOX RIVER

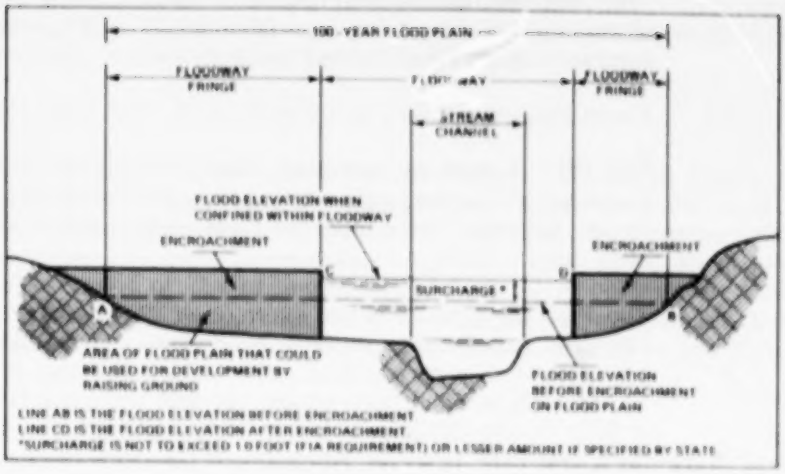
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
SURCHARGE *
A
B
C
D
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the Village of Little Chute.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the Village of Little Chute ar shown on the Flood Profiles (Exhibit 1) and are summarized in the Floo Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables Correlations between property damage from floods and their FHFs are use to set actuarial insurance premium rate tables based on FHFs from 005 t 200.

The FHF for a reach is the average weighted difference between the 10- an 100-year flood water-surface elevations expressed to the nearest 0.5 foot and shown as a three-digit code. For example, if the difference betwee water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FH is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-yea water-surface elevations is greater than 10.0 feet, accuracy for the FHF i to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entir incorporated area of the Village of Little Chute was divided into zones, eac having a specific flood potential or hazard. Each zone was assigned one o the following flood insurance zone designations:

Zone A: Special Flood Hazard Areas inundated b the 100-year flood, determined by approx imate methods; no base flood elevation are shown or FHFs determined.

Zone A3: Special Flood Hazard Areas inundated b the 100-year flood, determined by de tailed methods; base flood elevations ar shown, and zones subdivided according t FHF.

Zone B: Areas between the Special Flood Hazar Area and the limits of the 500-year flood including areas of the 500-year flood plai that are protected from the 100-yea flood by dike, levee, or other wate control structure; or areas subject t certain types of 100-year shallow floodin where depths are less than 1.0 foot; an areas subject to 100-year flooding fro sources with drainage areas less than square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Village of Little Chute is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

A Flood Plain Information was conducted for the unincorporated areas of Outagamie County (Reference 4). This area was studied by approximate methods and therefore will not exactly match the Little Chute Study. Flood Insurance Studies for the incorporated areas of Kaukauna, Kimberly, and Combined Locks, Wisconsin, are in agreement with this study (References 10, 11, and 12).

A Flood Hazard Boundary Map has been published by the Federal Insurance Administration (Reference 13). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, One North Dearborn Street, Chicago, Illinois 60602.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
FOX RIVER							
REACH 1	0002	–1.4	–0.5	0.6	015	A3	VARIES–SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

VILLAGE OF LITTLE CHUTE, WI
(OUTAGAMIE CO.)

FLOOD INSURANCE ZONE DATA

FOX RIVER

8.0 REFERENCES AND BIBLIOGRAPHY

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10. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, City of Kaukauna, Wisconsin, (in progress).

11. ----------, Flood Insurance Study, Village of Kimberly, Wisconsin, (in progress).

12. ----------, Flood Insurance Study, Village of Combined Locks, Wisconsin, (in progress).

13. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Village of Little Chute, Wisconsin, June 1974.

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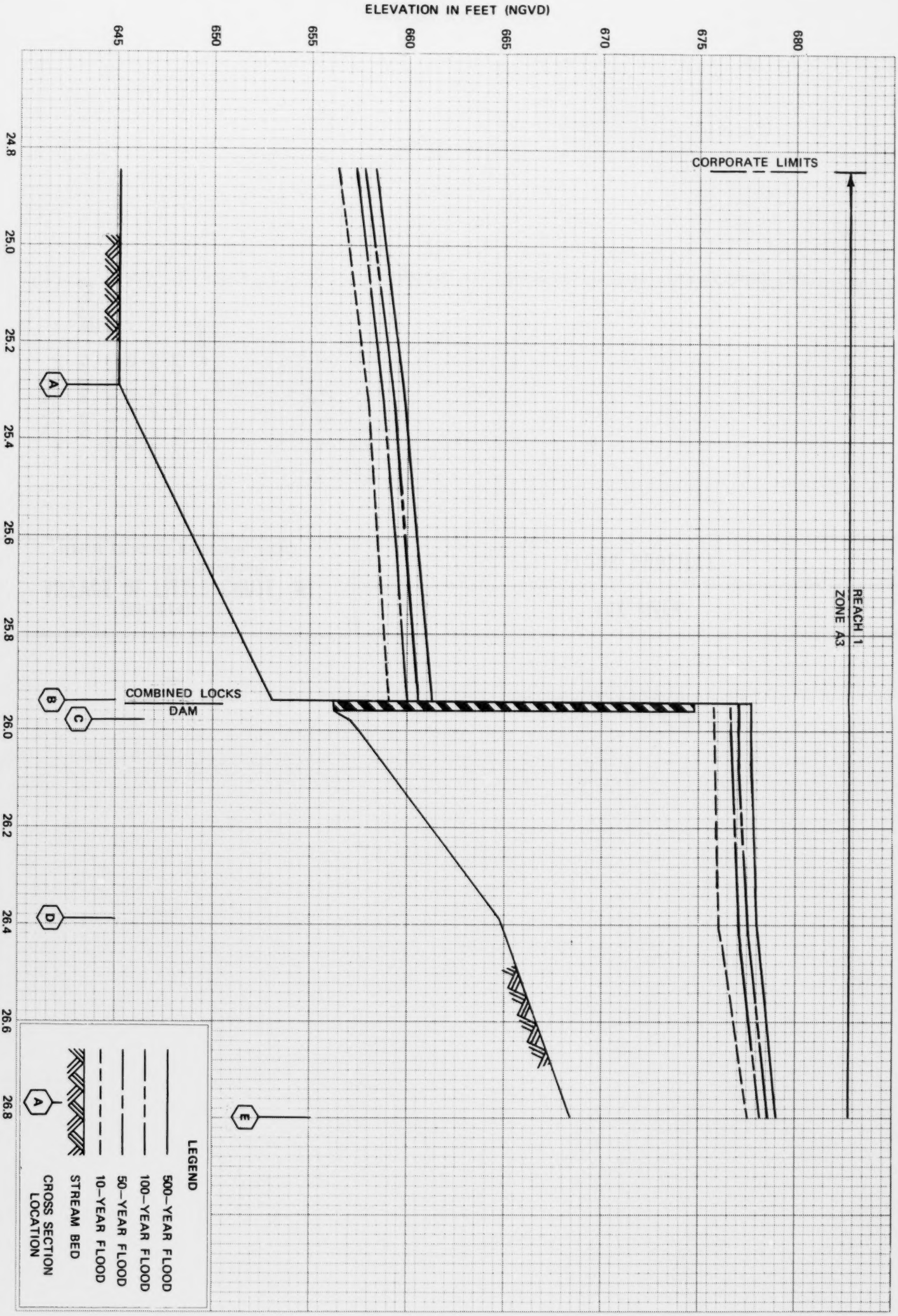
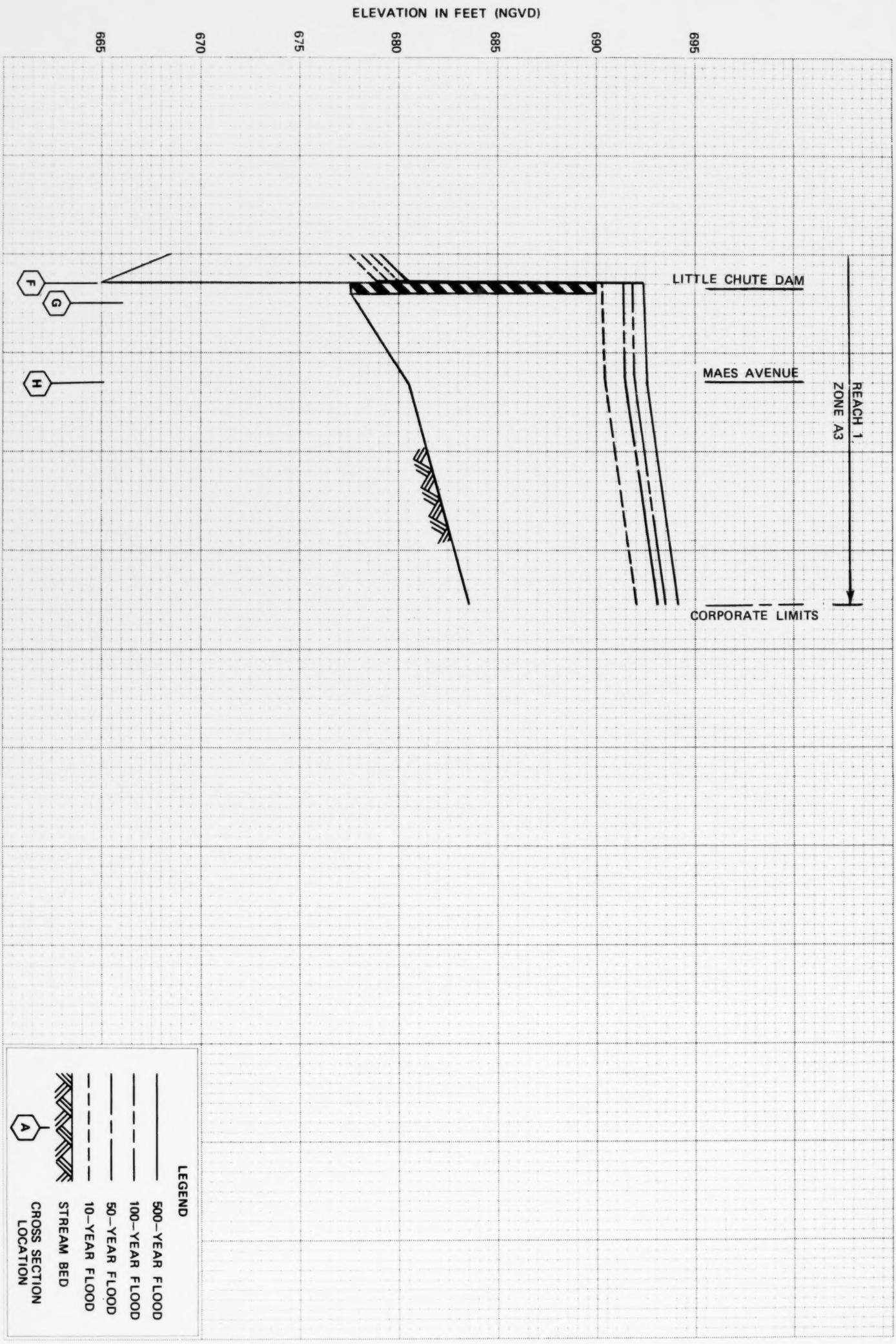


01P	FEDERAL EMERGENCY MANAGEMENT AGENCY Federal Insurance Administration **VILLAGE OF LITTLE CHUTE, WI** (OUTAGAMIE CO.)	**FLOOD PROFILES** **FOX RIVER**



02P

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
VILLAGE OF LITTLE CHUTE, WI
(OUTAGAMIE CO.)

FLOOD PROFILES

FOX RIVER